GS-RAM™

Including GS-RAM Plus & GS-RAM Ultra

User's Manual

APPLIED ENGINEERING®

A DIVISION OF AE RESEARCH CORPORATION

v3.01

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GS-RAM™

Including GS-RAM Plus
& GS-RAM Ultra

User's Manual

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Table Of Contents

About The GS-RAM Cards

Memory Expansion--All of the GS-RAM cards allows you to increase the Random Access Memory (RAM) capacity of your Apple IIGS. RAM is the memory that can be both read from and written to--the addressable (user useable) memory. Many programs automatically look for and use available RAM to give them more room to operate (desktop space). Many programs load themselves into the available RAM at startup. This greatly increases their performance because it reduces or eliminates the need to access the relatively slow mechanical floppy drives.

- GS-RAM lets you increase the available system RAM by a maximum of 1.5 Megabytes, in increments of 256K.
- With the GS-RAM Plus, you can expand the computer's memory as much as 6 Megabytes in steps of 1024K (1 Megabyte) using 1,024 x 1 DRAM chips.
- The GS-RAM Ultra allows you to expand up to 4 Megabytes in 1 Megabyte increments using 256K x 4 DRAM chips.

Piggyback--If someday you discover that you need even more memory, you can attach an optional 2 Megabyte "piggy-back" expander card to boost the total memory expansion for the GS-RAM up to 3.5 Megabytes, up to 8 Megabytes for the GS-RAM Plus, and up to 6 Megabytes for the GS-RAM Ultra. See Chapter 5, "More Memory" for more information about expanding the cards' memory.

RAM Disks--Use some of the GS-RAM memory to set up a RAM Disk. A RAM disk acts as an internal, electronic hard disk giving you super-fast access to applications copied to it. Loading from and storing to a RAM disk can be as much as 20 times faster than a conventional disk drive because it eliminates the mechanical activity required by a conventional drive.

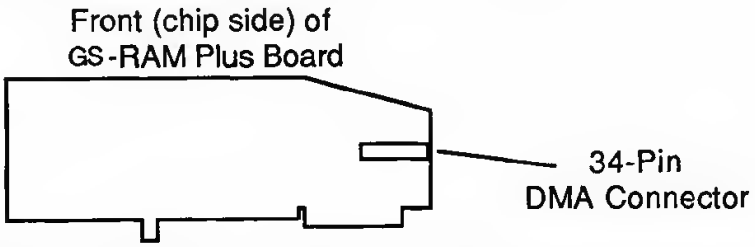
GS-RAM Ultra ROMs--The two ROM sockets on the GS-RAM Ultra (described in Appendix B) allow you to add ROM chips (as they become available) which will give you greater speed in loading tools, applications, etc.

DMA Support--The Apple IIGS is limited to expanded system memory of up to 8 Megabytes but only 4 Meg is Direct Memory Access (DMA) compatible. Most DMA peripherals will tell you that they require DMA.

All three of the GS-RAM cards are DMA compatible. A fully loaded GS-RAM card (Rev C or later) is compatible for all 1.5 Meg. A fully loaded GS-RAM Ultra is DMA compatible for all 4 Meg.

A GS-RAM Ultra with a 2 Meg Expander as well as the GS-RAM Plus are DMA compatible for up to 4 Meg and partially compatible above that. However, with the optional DMA Support Card, your GS-RAM Plus (Rev D or later) or GS-RAM Ultra will make all of the memory DMA compatible.

All of the GS-RAM Ultras have the DMA connector. You'll know that you have DMA compatible GS-RAM Plus if it has a 34-pin DMA connector toward the right edge of the front side of the board. (See below.)



RamKeeper--Connect the GS-RAM, GS-RAM Plus, or GS-RAM Ultra to an Applied Engineering RamKeeper to make it an "electronic hard disk." RamKeeper turns the volatile memory of the GS-RAM Disk into a non-volatile ROM Disk. When you turn off your computer, the memory allocated as the ROM Disk remains intact, ready to use the next time you boot. You can even connect two GS-RAMs or a GS-RAM and almost any other GS memory expansion card to RamKeeper and RamKeeper will recognize both cards as one big card. For example, you could connect a 2 Meg GS-RAM Plus and a 512K GS-RAM card to the RamKeeper and the computer would see it as 2 and 1/2 Meg of memory. You could also attach a 512K Apple Memory Expansion Card and a 4 Meg GS-RAM Ultra to the RamKeeper and the computer would recognize it as 4 and 1/2 Meg of memory.

AW 2 Expansion Software--With your GS-RAM, you've also received Applied Engineering's AW 2 Expander software. This program will greatly enhance the popular AppleWorks integrated software package adding such features as more Word Processor lines and Data Base records, an expanded clipboard, Multiple Disk Save and more.

Also included on the AW 2 Expander is a graphic test for your GS-RAM that will tell you which, if any, chips are bad and will also check for the proper type of chips.

Refer to the AW 2 Expander User's Manual for complete information about the disk.

About This Manual

❖ *Note:* Unless otherwise noted, "GS-RAM" refers to the GS-RAM, GS-RAM Plus and GS-RAM Ultra.

Below is a brief description of what is covered in each chapter of this manual.

Chapter 1 will take you quickly through the installation and testing of your GS-RAM card.

Chapter 2 tells you how to use some of the expanded memory as a RAM disk. This is a great way to increase the access speed to different applications.

Chapter 3 describes the Æ ≣*Cache* included on your AW 2 Expander disk. The ≣*Cache* will greatly increase your access speed to most applications. With the Æ ≣*Cache* installed, you will notice that the time it takes to load a program from an Apple Disk 3.5 drive is greatly decreased--even on the initial load!

Chapter 4, as mentioned above, helps you to decide what chips you will need to expand the memory of your GS-RAM card. It also explains how to install the chips yourself as well as how to return the card to Applied Engineering for a memory upgrade with no additional charge for the installation and testing.

Appendices provide you with a ProDOS tutorial as well as information about the GS-RAM Ultra's ROM sockets and with instructions on what to do when you encounter a problem that is not covered in the manual.

We have tried to make this manual as informative, understandable, and error-free as possible. If you have any comments or suggestions regarding this manual or any other Æ manual, we would be glad to hear from you.

Please address any comments or suggestions to:

Applied Engineering
P.O. Box 5100
Carrollton, Texas 75011
Attention: Manager, Technical Publications

Now, turn the page and let the memory begin!

CHAPTER ONE

Getting Started

- *Note:* If you're attaching the GS-RAM to a RamKeeper, follow the instructions in the RamKeeper manual.

This chapter tells you how to install and test the GS-RAM, GS-RAM Plus, and GS-RAM Ultra memory expansion cards. Before you install your memory-expansion card, please be sure to read *Setting Up Your Apple IIGS* and the *Apple IIGS Owner's Guide.* You'll need to be particularly familiar with the Control Panel functions as this manual makes frequent reference to the Control Panel menu.

Installation

1) **Turn off the computer.**

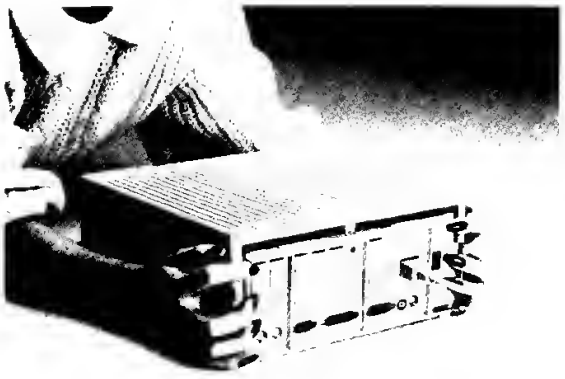
   Leave the computer plugged in but flip the power switch to the OFF position.

3) **Remove the Apple IIGS cover.**

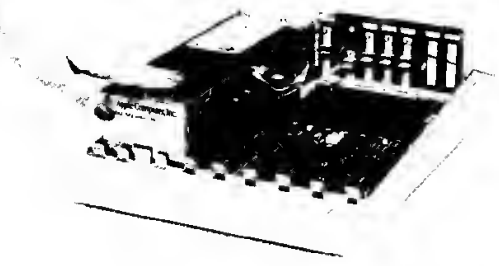
   Locate the two latches on either side of the backplate. Push in on the latches while pulling up and back on the lid.

4) **Touch the power supply case.**

   The case is shown in the illustration below. This will discharge any static electricity that may be on your body. Do not skip this step. Static electricity can ruin chips on the board and in the computer.



Remove the cover



Touch the power supply

5) **Remove the memory-expansion card from its anti-static bag.**

Hold the card by the edges, like a photograph. Do not touch the gold fingers of the card.

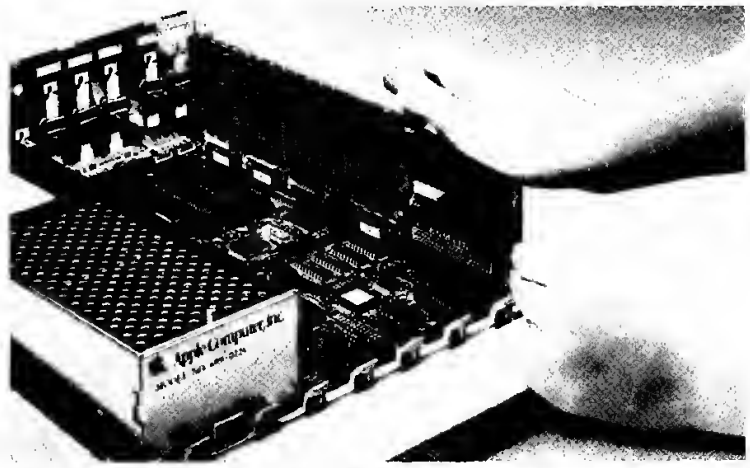
❖ *Note:* If you're attaching ROM chips to the Ultra follow the instructions in Appendix B; if you're connecting the DMA Support Card option to your Plus or Ultra, follow the instructions included with the DMA support card.

6) **Position the memory expansion card over the Memory Expansion Slot.**

The Memory expansion slot is located in the front right corner of the computer. Hold the card so that the long end of the card is toward the rear of the computer.

7) **Insert the card.**

Insert the gold edge-connector into the Memory Expansion Slot until it is completely seated. You can wiggle the card gently, back to front, to insure a firm connection.



Insert GS-RAM into the Memory Expansion Slot

8) **Replace the Apple IIGS cover.**

Slide the front of the lid in first, then press on the back edge until it snaps into place.

9) **Check the RAM Disk setting to verify correct installation.**

You can verify that the computer recognizes the additional memory by checking the RAM Disk option in the Control Panel menu.

First, turn on the computer then access the Classic Desk Accessories menu by holding down the Open-Apple and Control keys while pressing ESC ( -  then ).

Use the up and down arrow keys to select the Control Panel menu and press "return".

Select the RAM Disk option and press "return".

The number next to the Largest Selectable listing tells you the amount of memory that the system now has available.

10) **Make a copy of the AW 2 Expander disk.**

It is very important to make backup copies of your master disks when possible. The AW 2 Expander disk is not copy protected. You can copy it using the IIGS's Finder™. Simply drag the AW 2 icon to the icon of the destination disk.

If you don't use the Finder, you can use the "Copy Files" option of your GS utility disk or the "Filer" program included on the AW 2 Expander disk.

❖ *Note:* Instructions for copying with Filer are included in the Appendix of the AW 2 Expander manual. Instructions for copying with System Utilities are included in, *Apple IIGS System Disk User's Guide.*

After you copy the disk, store the master in a safe place.

11) **Test the card.**

Boot your COPY of the AW 2 Expander disk and select the GS-RAM Test program from the main menu. You can stop the test at any time by pressing  .

❖ *WARNING:* The GS-RAM test program will erase anything stored in extended memory.

12) **Installation is complete!**


GS-RAM

CHAPTER TWO

The GS-RAM as a RAM Disk

Many of the newer application programs take advantage of the extended memory automatically. However, you may want to use part of the extended memory to emulate a RAM disk. Creating a temporary RAM disk will give you much faster access to some applications (programs which do not automatically take advantage of the increased memory). The following section explains how to create a temporary RAM disk.

Setting Up a RAM Disk

If you want to set up the GS-RAM as a RAM Disk, run the Control Panel program from the IIGS Desk Accessories Menu (control-Ó-esc). Then select the RAM Disk option.

You must first tell the computer how much of the card's memory you want to set aside for use as a RAM disk. The minimum setting limits the amount of memory that applications can use. The maximum limits how much memory the RAM disk can use. You'll want to leave enough memory open to support the programs that automatically take advantage of the extra memory.

- *Note:* If working with GS/OS or an application that uses a version of ProDOS before 1.2, the minimum and maximum RAM disk settings must be equal.

If an application needs more memory than you have allotted, a message to that effect will come up on the screen. You can adjust accordingly by selecting "RAM Disk" from the Control Panel program and decreasing the maximum RAM disk size.

Changing the Control Panel setting will not change the currently established RAM disk. You will have to turn off the power to establish a RAM Disk of a different size. The new settings will take affect upon startup.

❖ *Remember*: Powering down will in turn erase what is currently in the temporary RAM disk you have created. Save any data from the RAM Disk that you do not want to erase before powering down.

Addressing the GS-RAM Disk

Some applications may ask you to identify your RAM disk by slot and drive number.

SLOT: The GS identifies your mock RAM disk in slot 5 just as it recognizes a 3.5" drive as being in slot 5.

DRIVE: The drive number will depend on what you decide to use as your startup device. Drive 1 can be either the RAM disk or a 3.5" drive. Choose one or the other using the "Slots" heading under the Control Panel Program.

-- First, make sure slot 5 is set to "Smart Port."

-- If you want the computer to boot your RAM disk at startup, select "RAM Disk" next to the "Startup Slot" heading. The GS will recognize the RAM disk at, S5,D1 and the 3.5" drive will be S5,D2.

-- If you want the computer to boot your 3.5" drive at startup, enter "5" (or "Scan") under the "Startup Slot" heading. The GS will recognize the 3.5" drive at S5,D1 and the RAM disk will be S5,D2.

-- A second 3.5" drive will be S2,D1. The following chart may help you to understand:

Boot "Slot 5"	Boot "RAM Disk"
S5,D1 ---- 3.5" drive S5,D2 ---- RAM disk S2,D1 ---- 3.5" drive	S5,D1 ---- RAM disk S5,D2 ---- 3.5" drive S2,D1 ---- 3.5" drive

❖ *Note:* If using ProDOS® 1.1.1, your second 3.5" drive (S2,D1) will not be recognized. This early ProDOS version allows only two devices per slot. See your authorized Apple dealer to upgrade your applications which use ProDOS 1.1.1.

Using the GS-RAM Disk

Now you are ready to use the RAM disk you have created. Think of it as a regular disk. You can format it then save or copy documents or applications onto it.

> ❖ *Remember:* The RAM disk is only a disk as long as the power is on. The information it contains is lost when the power is turned off (unless you have saved that information to a disk or disks).

FORMATTING

You need to format the RAM disk only if you plan to use it as your startup device. The disk will be automatically formatted at startup for saving and copying. So, if you plan only to save to and copy to the disk, you don't need to worry about formatting. If, however, you plan to use the RAM disk as a startup device, format the disk just as you would a regular disk. Format for either ProDOS, Pascal or Applied Engineering's CP/AM (5.1.1 or later) depending upon the operating system of the application(s) you intend to store on the RAM disk. Here are a few ways to format for the different systems:

- Format for ProDOS using the "Format" option on your IIGS System disk or IIGS System Utilities. Or, you may find it easier to use the Finder's "Format Disk" option under the "Special" menu.
- Format for Apple Pascal 1.3 by X-ecuting the "Formatter" program on your Pascal disk. (Refer to Apple Pascal documentation for more information on formatting for Pascal.)
- To format for CP/AM versions 5.1.1 and following, refer to the formatting instructions in the CP/AM manual.

❖ *Note:* Do not try to format the disk for DOS 3.3. The 3.3 applications were designed for use with 5.25" disks and will not work with the IIGS RAM disk.

You can give the RAM disk any name that the operating system will allow.

CHAPTER THREE

Æ ≣Cache

❖ *Note:* GS/OS has its own caching system. If you're using GS/OS, do not use the Æ ≣Cache™.

Those of you who want to know what the ≣Cache is, read "About the ≣Cache" at the end of this chapter. Those of you who know what it is and want to install it right away, here's how...

Requirements

To use the Æ ≣Cache, you must have the following:

❑ A RamKeeper card with any compatible memory card attached.

or

A GS-RAM™ card installed in the IIGS's Memory Expansion Slot.

❑ An Apple 3.5 Drive.

❖ *Note:* The ≣Cache supports only the Apple Disk 3.5™ Drives (platinum). It will not cache the Apple II Uni-Disk™ 3.5 drives (white) nor will it cache 5.25" drives or hard disks.

Important: You must set Slot 5 in the Control Panel menu to the `Smart Port` setting.

❑ A COPY of the AW 2 Expander disk, version 2.5.3 or later.

Installing the ≣Cache

You may have noticed that there are two `AECACHE` files on the AW2 Expander disk. ProDOS 8 uses only the AECACHE.SYSTEM while ProDOS 16 can use both `AECACHE.SYSTEM` and `AECACHE.SETUP`. First, decide if you'll be using ProDOS 8 only or ProDOS 16 only or if you'll be switching between the two, and then follow the appropriate directions below.

ProDOS 8 Only

If you plan to use only ProDOS 8:

1.) **Boot your COPY of the AW 2 Expander disk**

2.) Select **AE Cache** from the AW 2 Expander main menu or execute the file, AECACHE.SYSTEM.

While executing, the program will display the Æ startup screen accompanied by the message:

```
INSTALLING....
```

at the bottom of the screen.

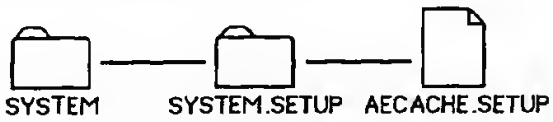
If the ≡*Cache* program does not find a properly installed RamKeeper or GS-RAM card, it will print the following message to the monitor:

```
REQUIRES GS-RAM
OR RAMKEEPER W/ MEMORY CARD
IN IIGS MEMORY EXPANSION SLOT
```

❖ *Important:* Switching from ProDOS 8 to ProDOS 16 with AECACHE.SYSTEM operating will cause unpredictable results. If you want to switch between operating systems, adhere to the following directions for ProDOS 8 and ProDOS 16:

ProDOS 16 and ProDOS 8 or ProDOS 16 Only

If you'll only be using ProDOS 16, or if you'll be switching between 16 and 8, use the IIGS Finder or System Utilities to copy the AECACHE.SETUP file (from the AW 2 Expander disk) into the SYSTEM.SETUP folder located within the ProDOS 16 System folder on your boot disk(s) (see below).



Where the file goes

Booting these modified disks will load the AE Cache option into your Classic Desk Accessories menu.

❖ *Note:* You must cold boot into ProDOS 16 to enable the AECACHE.SETUP file to work under both systems. You can then switch between ProDOS 8 and ProDOS 16 without deinstalling or reinstalling the ≡*Cache*.

If the ≡*Cache* program does not find a properly installed RamKeeper or GS-RAM card, the AE Cache option won't appear in the Desk Accessories menu.

You can also load the ≣*Cache* from ProDOS 16 by running the file AECACHE.SYSTEM.

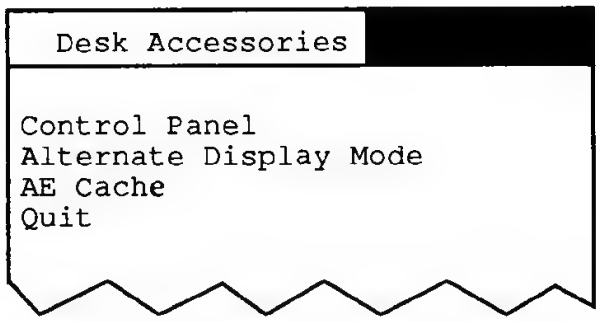
- *Important:* Warm booting ProDOS 8 or ProDOS 16 (Control-Reset or PR#s) with AECACHE.SYSTEM operating will cause unpredictable results. If you want to switch between operating systems, either cold boot (Open-Apple-Control-Reset) or copy the AECACHE.SETUP file into the SYSTEM.SETUP file as described above.

Running the ≣*Cache* in this way will not load the Desk Accessory into the Control Panel.

Setting the ≣*Cache* Size

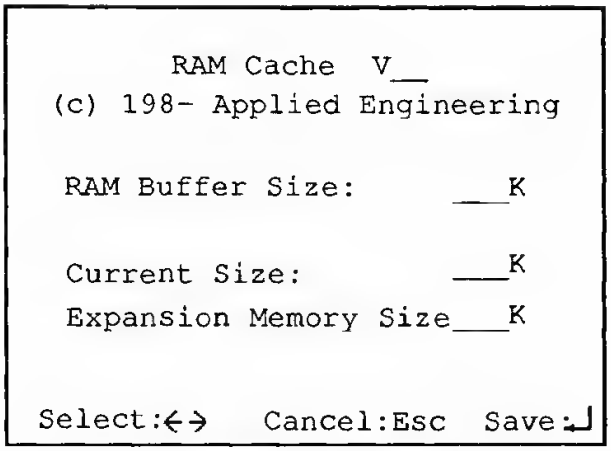
Once the Æ ≣*Cache* is installed, it will automatically increase your productivity. All you need to do is decide how large you want the ≣*Cache* to be.

1.) **Access the IIGS Classic Desk Accessories Menu.** (Open-Apple-Control then Esc). You should see a menu like the one below. (Yours may differ slightly according to the Classic Desk Accessories you use.) Notice the new option -- AE Cache.



Classic Desk Accessories Menu

2.) **Select the new option** using the arrow keys and return. You'll see the RAM Cache menu below.



RAM Cache Menu

3.) **Change the size of the RAM buffer** to the size you want. Press the right and left arrow keys to increase and decrease the RAM buffer size.

You don't have to power your computer down and back up to change the size of the cache like you do when you change the size of a regular RAM Disk. Simply select the size you want and then press return. If you access the AE CACHE option again, you'll see that your new setting has taken effect.

Setting the RAM Buffer Size

The Expansion RAM Size: heading displays the entire amount of memory on the memory expansion card. If another program or utility is using some of the extended memory, the RAM Buffer will not be able to use all of the memory indicated by the Expansion RAM Size:. But it can use the free memory available at that time for a RAM Buffer.

If you request more memory than is free at the time, the *Cache* will use as much free memory as is available. The *Cache* won't automatically fulfill your size request once the memory becomes free. If a program frees any memory, you can use that memory as a RAM Buffer by resetting the RAM Buffer Size in the AE Cache option in the Desk Accessories menu.

Removing the ≣*Cache*

To remove the ≣*Cache* from the system:

ProDOS 8

Cold boot your computer by doing either of the following:

- Press and hold down the control and Open-Apple keys ()while pressing and releasing the reset key.
- Power down--turn off the computer, then power up--turn it back on.

After you cold boot, access the Desk Accessories menu and note that the AE Cache option is gone.

ProDOS 16

Remove the AECACHE.SETUP file from the SYSTEM.SETUP file and reboot or cold boot from a boot disk that doesn't have the AECACHE.SETUP file installed.

About the ≣*Cache*

Part of the reason the Æ≣*Cache* is so incredibly fast at retrieving information is that it allows ProDOS to read a whole track every time it accesses the disk drive instead of reading individual blocks. This method, called "track caching," makes even the initial read much faster--up to twice as fast as a system without a cache. All subsequent calls are sped up even more because the system does not have to access the disk drive every time you request information. In fact, subsequent accesses are often faster than accesses from a RAM Disk!

The ≣*Cache* installs itself onto the Smart Port and will operate with ProDOS 8, ProDOS 16, Apple Pascal 1.3, and Æ's PC program for CP/AM. It uses some of the expanded memory for itself plus the amount of memory you allocate to it.

When the cache program reads a track, it stores the entire track in the Track Buffer and stores the block(s) containing the requested information in another buffer, the Cache Buffer. You can set the Cache Buffer to the size you want, depending upon the memory size of your GS-RAM card and how much of that memory you have allotted for use as a RAM Disk.

When the Cache Buffer becomes full, it will make room for the most recently requested data by replacing the blocks that have been stored in the buffer the longest without being accessed. The Track Buffer is not variable; it is large enough to hold one track (6K) and cannot be changed.

When you call for information, the system first looks in the Cache Buffer. If the information is there, it reads it with speed comparable to (often even faster than) reads from RAM Disks and internal hard disks. If it doesn't find the information in the Cache Buffer, it checks the Track Buffer. This takes little more time than reading from the Cache Buffer because the system is still not required to read the disk drive.

If the information is not in the Track Buffer, the system will then go back out to the disk drive, find the information, and read the entire track to the Track Buffer. This new track replaces the track currently held in the Track Buffer.

While this method actually goes through more steps than a non-cached system to get information that is not stored in the buffer, the actual time it takes the system to check the Cache Buffer and Track Buffer is insignificant.

Copy Protected Programs

Some copy protected programs have a disk accessing function of their own and cannot use the ≣*Cache*. However, most programs will use the cache with no problem.

CHAPTER FOUR

Adding More Memory

Where to Get Chips

Selection of the proper memory chips for your GS-RAM can be a little tricky. There are several chip manufacturers and many different types and specifications of RAM chips available.

You may be able to find memory chips with the proper specifications at some computer or electronics-parts stores. But we recommend that you purchase them from Applied Engineering. Applied Engineering receives bulk-quantity discounts on purchases of memory chips and can often offer them for less. Applied Engineering uses only the highest-quality memory chips and warrants them for a full 5 years. (Most electronics-parts vendors sell their chips "as-is.") We will not warrant chips purchased from other vendors. When you get ready for more memory, give Applied Engineering a call. You'll be assured of getting the right chips at the right price.

GS-RAM and GS-RAM Plus Choices

Your GS-RAM can contain up to 1.5 Megabytes using 256K RAM chips; GS-RAM Plus, up to 6 Megabytes using 1 Meg RAM chips. Memory on both cards is organized into six blocks, designated blocks A, B, C, D, E, and F, shown in the illustration at the top of the next page. Each block consists of eight memory chips. You must add these chips in groups of eight, filling the blocks in order, A-F.

GS-RAM requires 256K x 1 Dynamic Random Access Memory (DRAM) chips. GS-RAM Plus uses 1024K x 1 DRAM chips. For the 256K chips we recommend a speed specification of 150 nanoseconds or less (for example, -15, -12) and for the 1 Megabyte chips, we recommend a speed specification of 120 nanoseconds or less (-12, -10). Both 256K and 1 Meg chips must support the "CAS before RAS" method of memory refresh. We have included a list below to help you decide which chips you should use.

The chips listed below are the chips that we have tested and know will work with the GS-RAM and GS-RAM Plus cards.

GS-RAM

Samsung	KM41256-15
Hitachi	HM50256-15
Intel	P21256-15
Mitsubishi	M5M4256P-15
Fujitsu	MB81256-15
OKI	MSM41256A-15AS/RS
	M41256A-15
Micron Tech.	MT1259-15
Toshiba	TMM21457-15
Texas Instr.	TMS4256-15NL
Motorola	MCM6256BP15
NEC	D41256-15 (if date code 87 or later)

GS-RAM Plus

Hitachi	HM511000-12
	HM511001-12
Toshiba	TC511000-12
	TC511001-12
OKI	MSM411000RS-12
	MSM411001RS-12
NEC	D421000C-12
	D421001C-12

DO NOT use the chips below on the GS-RAM:

AT&T	M41256PP15B
Toshiba	TMM41256-15
Siemens	HYB41256/7-15
OKI	M41256-15
NEC	D41256C-15 (if date code 86 or earlier)

GS-RAM Ultra Choices

The GS-RAM Ultra can be upgraded to 4 Megabytes in 256K increments using 256K x 4 DRAM chips. You'll need to install two chips at a time (2 chips equals 256K). These chips are available from many dealers and from Applied Engineering.

The chips listed below are the chips that we have tested and know will work with the GS-RAM Ultra.

GS-RAM Ultra

NEC	D424256C-15
Sharp	LH64258-15
Toshiba	TC514256P-15
Mitsubishi	M5M44256AP-15
Texas Instr.	TM544C256-15N

Installing the Chips

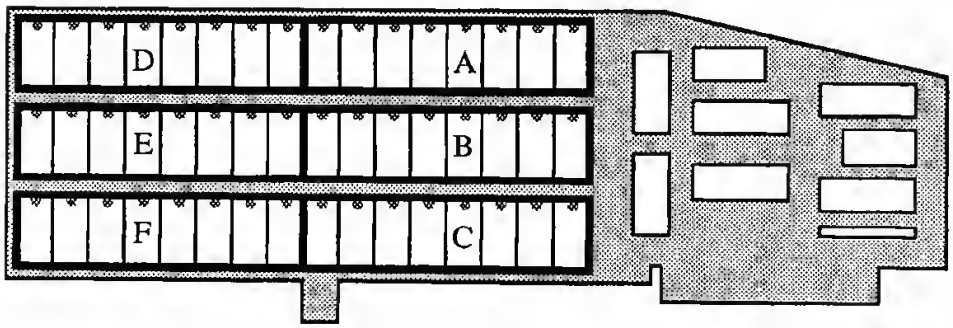
❖ *Reminder:* You may return your GS-RAM card to Applied Engineering for a memory upgrade with no additional charge for the installation or testing. Call the Applied Engineering sales office for the latest memory-chip prices and shipping instructions. The sales office telephone number is (214) 241-6060.

There is nothing complicated about installing RAM chips onto the memory expansion cards. Just follow these basic guidelines:

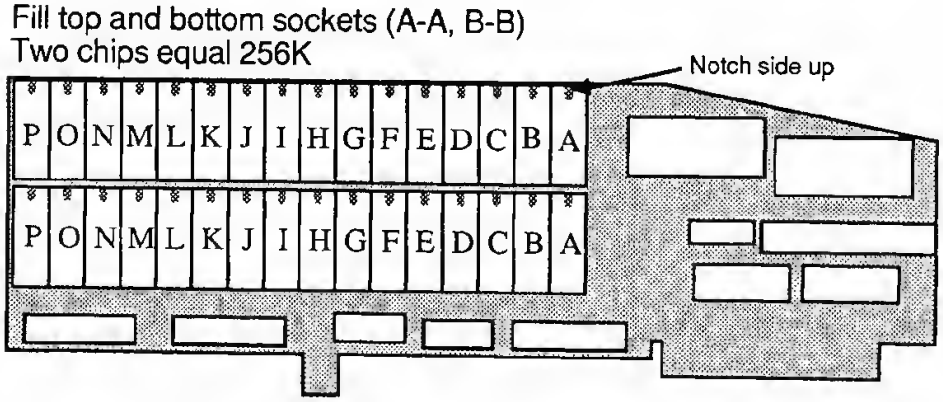
Fill the memory blocks in alphabetical order (i.e. fill block A, then block B, then block C...). Refer to the illustrations below.

1) Remove the card from your computer if it is currently installed.

❖ *Warning*! Static electricity can ruin chips. Touch the power supply before handling the board or the chips.



GS-RAM and GS-RAM Plus configuration:



GS-RAM Ultra configuration:

2) Orient the chip so that the notch (or dot, on some chips) points UP, away from the gold edge-connector on the bottom of the card.

❖ *Warning:* If you install a chip upside down it could possibly damage the chip. Be sure to double check the orientation notch.

3) Align each leg (pin) of the chip with its socket hole. You may have to bend the pins slightly to align them with the holes. Do this by holding the chip on edge so that one of the rows of feet are against the table's surface. Now apply downward pressure to the chip while rolling it toward the bottom of the pins. This will bend the pins uniformly.

4) Press down firmly on each chip to ensure that it is fully seated in its socket. Check closely for bent pins.

5) Reinstall the card then test it using the appropriate GS-RAM memory test included on the AW 2 Expander disk. The test will give a graphic representation of the card and indicate which chips are missing, bad or improperly installed.

APPENDIX A

A Brief ProDOS Tutorial

This is a brief explanation of the Professional Disk Operating System, ProDOS, for those who are completely new to it. All of this information and more is included in your *Apple Owner's Guide*, but we have provided it here for your convenience.

Operating System

ProDOS is one of several operating systems for the Apple. Others include DOS 3.3 and Pascal. Operating systems, as defined in the *Apple Owner's Guides*, are programs that control how information is loaded into memory, how the computer handles the information, how the information is stored on a disk, and how the computer communicates with the printer and other peripherals.

Naming Volumes

ProDOS must have a way to locate which disk (often called "volume") you want to access. Instead of typing in the location of the disk as in DOS 3.3 (ex: S6,D1), you simply type in the name of the disk (the volume name). Some rules for volume names are

1) Name can include letters, numbers, or periods but not spaces
2) Name must begin with a letter
3) Name can be up to 15 characters long

These rules also hold true for subdirectory names.

Root Directory and Subdirectory

The main directory of the volume is called the root directory. The root directory uses the same name as your disk. Subdirectories are ProDOS' way of organizing information on a disk.

Think of the root directory as a file drawer and the subdirectories as folders within the drawer. You can

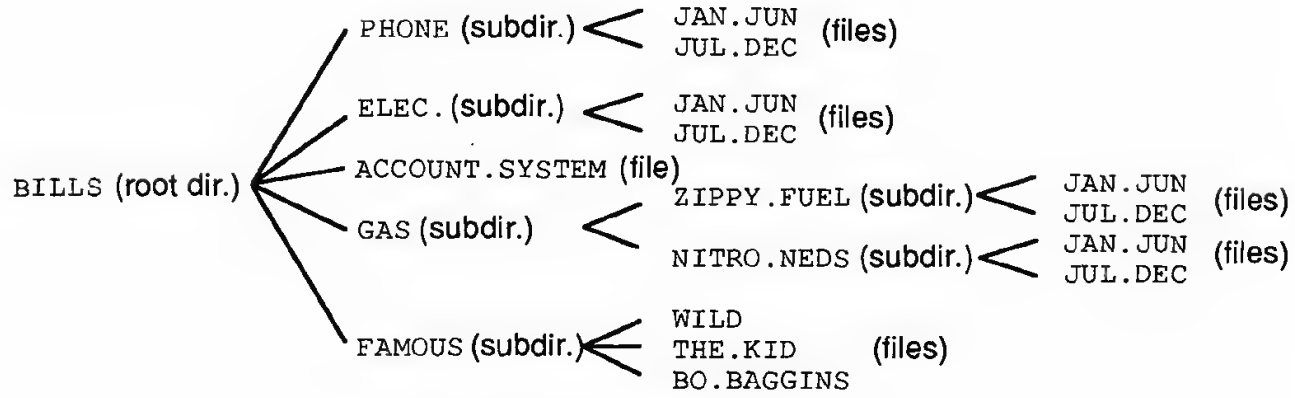
1) Put files directly into the root directory like putting documents straight into the file drawer

2) Put files within subdirectories like putting documents in folders

3) Put subdirectories within subdirectories like putting folders within folders.

Pathname

The name of the directory combined with the names of one or more subdirectories is called a pathname. Volume names and subdirectory names are preceded by a slash, "/". (Note that some applications add the slash for you.) For example, you could have a volume named /MY.DISK and a file called MY.FILE on the root directory of that disk. To access that file, you would use the pathname /MY.DISK/MY.FILE. You could also have a file JUL.AUG in a subdirectory (folder) called PHONE on a disk called /BILLS. To access that file, you would use the pathname /BILLS/PHONE/JUL.DEC. Refer to the diagram below.



ProDOS Directory Structure

Now when an application asks you for the pathname of a file, you'll have a basic understanding of what it expects.

System Files

A system file is a ProDOS file that starts an application. Typically, these files have the suffix .SYSTEM (e.g. /APLWORKS.SYSTEM, /ACCOUNT.SYSTEM [see above], etc.). When you boot ProDOS, it runs the first system file listed in its directory. So, if BASIC.SYSTEM is the first system file on your ProDOS boot disk, ProDOS will boot and then put you in BASIC.

Additional Resources

The following books are available through most book stores:

Apple II Owner's Manual (Apple Computer, Inc.) Supplied with your Apple Computer. Take the time to read it.

Basic Programming with ProDOS (Addison-Wesley Publishing) Gives a detailed explanation of how to use ProDOS from AppleSoft Basic.

Beneath Apple ProDOS (Quality Software) Provides information about ProDOS for both the novice Apple user and the advanced programmer.

ProDOS Inside and Out (TAB Books) Very good book for both the beginning and advanced BASIC Programmer.

ProDOS User's Manual (Apple Computer, Inc.) Provides an overview of ProDOS and explains how to use the ProDOS User's Disk.

APPENDIX B

GS-RAM Ultra ROM Sockets

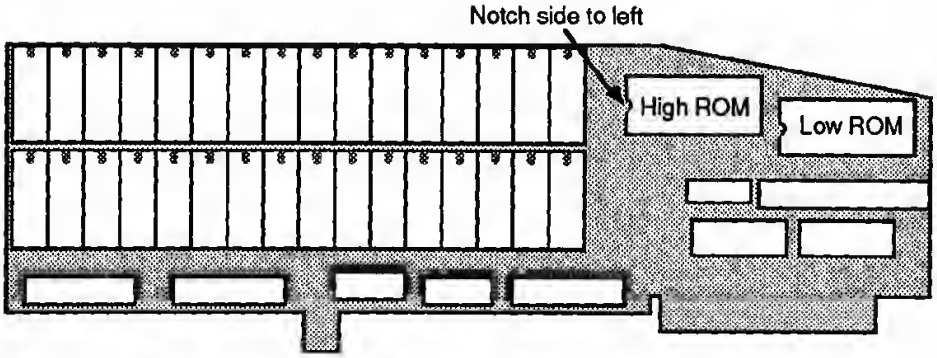
The GS-RAM Ultra's ROM sockets do not need to be filled for the card to work as memory expansion. However, when Eproms containing applications, tools, and utilities become available, you'll be ready to take full advantage of the increased speed they offer.

Installing the ROMs

It's very easy to install the ROMs into the sockets:

1) Remove the card from your computer if it is currently installed.

❖ *Warning*! Static electricity can ruin chips. Touch the power supply before handling the board or the chips.



ROM Sockets

2) Orient the chip so that the notch (or dot, on some chips) points toward the left (back edge) of the card.

❖ *Warning:* If you install a chip backwards it could possibly damage the chip. Be sure to double check the orientation notch.

3) Align each leg (pin) of the chip with its socket hole. You may have to bend the pins slightly to align them with the holes. Do this by holding the chip on edge so that one of the rows of feet are against the table's surface. Now apply downward pressure to the chip while rolling it toward the bottom of the pins. This will bend the pins uniformly.

4) Press down firmly on the chip to ensure that it is fully seated in its socket. Check closely for bent pins.

Technical Info

The following information is provided for those programmers interested in accessing the ROM chip sockets.

What Chips?

The board can accept 27256 & 25512 Eproms or 1 Meg ROMs.

Memory Locations

- The Low ROM chip (on the right) maps at $F8000.
- The High ROM chip (on the left) maps at $FA000 and again at $FC000.

APPENDIX C

Getting Help

If you have a technical question relating to your GS-RAM card or any other Applied Engineering product that is not covered in the manual, please contact the dealer from whom you purchased the product. If you are experiencing difficulties with one particular program, contact the program's author or publisher.

In the event that the dealer or the publisher's support personnel cannot answer your question, call Applied Engineering Technical Support. The support representatives are experienced in the applications and uses of Applied Engineering products, but in order to provide a quick and effective answer to your question, they will need to know as much as possible about the hardware and software specifically related to your question. Please provide the technical support representative with the following information:

- ◊ The Applied Engineering product related to your question and its revision number.
- ◊ The original and current memory configuration of the card (if applicable).
- ◊ The model and revision of your computer.
- ◊ What peripherals are being used and what cards are in each slot.
- ◊ The name, version, and revision level of the software with which you are experiencing problems.
- ◊ The results of any test programs, diagnostics, or troubleshooting done by you, your dealer, or your software publisher's support department.

Applied Engineering
Technical Support
(214) 241-6069
9 AM to 12:30 PM & 1:35 PM to 5 PM(CST)
Monday Through Friday

(Please call only the number above for technical support. Our sales office cannot transfer calls to the support lines.)

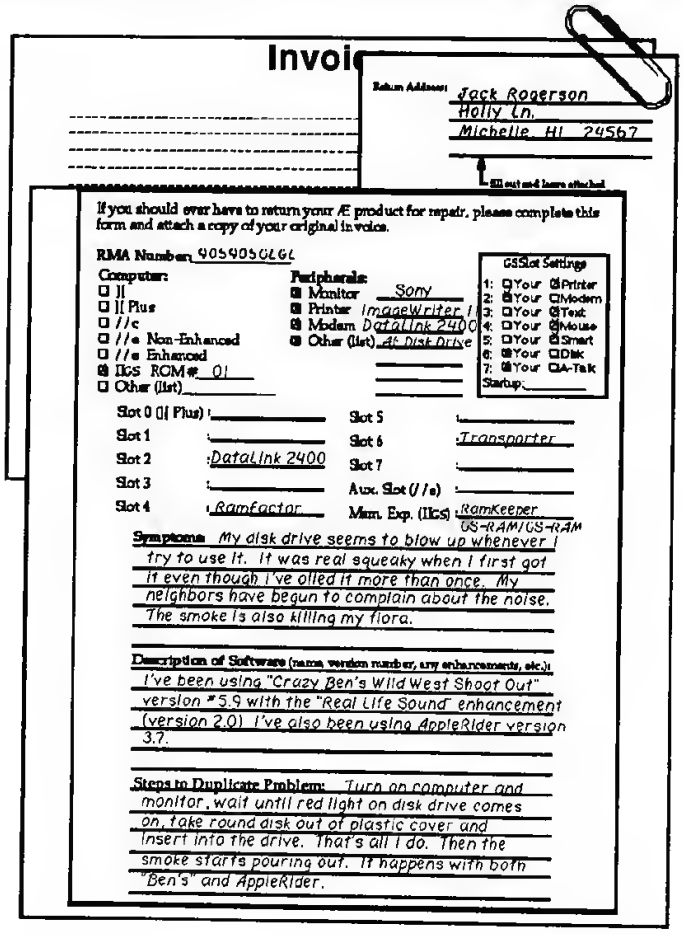
Returning a Product

RMA Number , "Attention" Sheet, and Invoice

If your product needs to be returned, the technical support representative will give you a Return Material Authorization (RMA) number.

- ❑ Record the RMA number for your own records.
- ❑ Write the RMA number on your package label.
- ❑ Fill out the Return Form on back of the yellow sheet marked "Attention!" A complete form will greatly reduce the time it takes to return your package.
- ❑ Attach a copy of your original invoice to the form.
- ❖ *Warning:* If you don't include an invoice, products will be treated as out of warranty products and will be returned to you C.O.D. for the amount of the service charge.

A completed form should look something like the one below.



When You Ship

If you don't have the original packing material, wrap the board in anti-static material (preferably the anti-static bag in which the card was originally shipped; however, aluminum foil will work fine). Pack it in a sturdy box cushioned with wadded papers (i.e. used computer paper or newspaper).

- ❖ *Warning*: If your product is damaged due to inadequate packing, your warranty will be void.

Include the return form and invoice.

Send the package, shipping prepaid, to:

RMA#__?__
Applied Engineering
Technical Support
3210 Belt Line Road, Suite 154
Dallas TX 75234

You should insure your package. Æ will not assume any responsibility for inadequate packing or loss or damage during shipping.

When We Receive

Our service department will use your completed form in an attempt to duplicate the problem.

If it is determined that your product is defective due to a manufacturing defect, your card will be repaired or replaced at Æ's option.

Any misuse, abuse, or non-Æ authorized alteration, modification, and/or repair to the Applied Engineering product will void the warranty. This warranty will also be void if you use the Æ product for any purpose other than its intended use.

Your product will be fully tested before it is shipped back to you, transportation prepaid, via UPS regular delivery.

Once your product is received by Technical Support, it will be processed and delivered to our shipping department within 7 to 10 working days.